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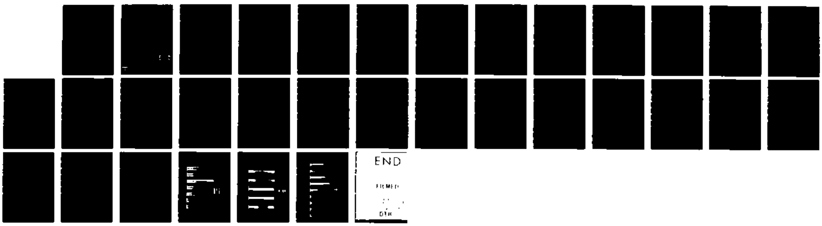

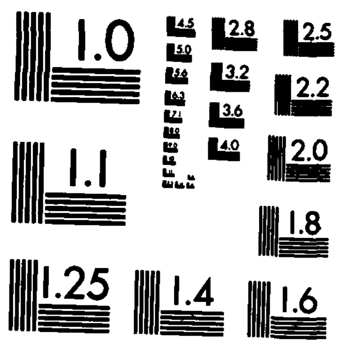

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Warren D. Tuttle

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USAF EXPERIENCE IN AIRCRAFT ACCIDENT SURVIVABILITY

by

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AIRCRAFT CRASHWORTHINESS SYMPOSIUM

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The views expressed herein are those of the author and do not necessarily reflect the views of the US Air Force or the Department of Defense

INTRODUCTION

This study reviews and analyzes the survivability potential of the United States Air Force (USAF) cargo/transport aircraft accidents from 1967 through 1974. The scope of this effort is limited to Air Force transport aircraft accidents where at least one individual was killed. Only the crashworthiness of the vehicle, as related to the ability to survive, has been considered in this report. There was no attempt to evaluate the crashworthiness characteristics of these aircraft with respect to the prevention of injury unless the specific injury incurred was the primary reason for the individual's death.

Previous analyses of this nature[1,2,3,4,5] have been accomplished by personnel assigned to the Air Force Inspection and Safety Center. Therefore, this paper may appear to duplicate these efforts and analyze the same shortcomings in survivability which existed in the late 1950's and early 1960's. To some degree this is true; however, when reviewing the primary cause for fatalities in transport aircraft accidents, it becomes apparent that most of the crashworthy deficiencies existing during that earlier time frame still remain unresolved.

Also present in this paper are several design improvements which should be considered to improve accident survivability.

Although such features could be included in the existing transport fleet through a retrofit program, the main emphasis now is to insure these improvements are contained in aircraft still in the design stage, which will be added to the Air Force inventory in the near future. In this regard, the most effective remedial actions that can be pursued, with consideration of monetary limitations and weight penalties, will receive priority.

METHODOLOGY

This review focuses on 16 various cargo/transport aircraft. In all, 91 fatal accidents which produced 845 fatalities received detailed consideration.

To assist in developing the most accurate conclusions, all sources of information which could describe the accident dynamics and relative events were carefully screened. This would include survivors' narratives, pictures of the wreckage, and comments by the on-scene investigators.

The primary reference for this information, the accident report, was helpful; however, improvement in investigation procedures, and the resulting report, was obviously needed. This is especially true when dealing with passengers' versus crew members' survival potential. A recent General Accounting Office review,[6] which addressed civilian aircraft accident investigations, accurately describes

techniques which are also representative of military aircraft investigations.

> The emphasis during investigation is toward accident prevention, that is, determining the cause of the accident. The extent of information gathered on causes of injuries and fatalities depends on the makeup of the investigation team, which varies from accident to accident. As a result, there is no systematic approach for obtaining this information which could be used to determine what is needed to improve the crashworthiness of aircraft.

The overall accident record of cargo/transport aircraft was evaluated to determine specific trends in rates experienced during the 8-year study period. These rates provided some comparative figures for subsequent analysis of survivable accidents. Survivable accidents were analyzed in depth to determine the primary cause of death for each survivable death. Also, any additional factors present during the accident which may have contributed to the individual's demise were considered in order to determine the most feasible methods to improve survivability.

Some accidents occurred at sea and some or all of the bodies were not recovered. In those cases where there was no indication as to the severity of the impact forces, individuals were included in the total number of aircraft fatalities; however, they were not considered in the subsequent classification regarding survivable potential. The only aircraft suicide occurring during the time frame was handled in the same manner.

EXPLANATION OF TERMS

Major accident	-	A cargo/transport aircraft accident in which the aircraft is destroyed or receives substantial damage as defined by Air Force Regulation 127-4.
Major accident rate	-	Number of major accidents per 100,000 flying hours.
Fatal accident	-	Any major cargo/transport aircraft accident in which at least one occupant of the cargo/transport aircraft was killed.
Fatal accident rate	-	Number of fatal accidents per 100,000 flying hours.
Fatality	-	An occupant of an Air Force cargo/transport type aircraft who died when that aircraft was involved in an accident in which the aircraft sustained major damage.
Fatality rate	-	Fatalities per 100,000 flying hours.
Impact death	-	A fatality resulting from impact forces which exceed human tolerance, from deformation of the cabin structure during the deceleration, from penetration of the cabin/cockpit by foreign objects (including external aircraft components, i.e., propeller blades), or from injuries sustained because assigned duties denied the use of proper seats or personal restraints. This category would include those missing at sea if recovered wreckage or eyewitness report revealed catastrophic impact forces. It would not include crashworthy deaths.
Survivable accident	-	Cargo/transport aircraft crash in which at least one survivable death occurred. Major accidents in which all occupants survived are "survivable accidents" but were excluded from this study.

Survivable death - A fatality which could have been prevented if the individual had egressed the aircraft prior to exposure to lethal post-crash factors or if proper crashworthy design or procedures would have prevented mortal injury.

Crashworthy death - Survivable death caused by mortal injuries due to poor crashworthy aircraft design, seat or personal restraint failure, improper cargo restraint, or non-use of available restraints.

Failure to egress death - Survivable death caused by post-crash factors including burns/asphyxiation, asphyxiation only, or drowning.

Survivability ratio - Number of survivors from a survivable crash divided by the sum of the survivors and the survivable deaths.

HISTORICAL ACCIDENT RATE

Before investigating the crashworthiness of current aircraft, it may be worthwhile to review the USAF accident experience since manned flight entered the military arena. Figure 1 depicts the fatal accident rate and fatality rate from 1921 to 1973. It should be noted that these rates reflect all aircraft accidents and are not limited to cargo/transport. The steady decline in the fatal accident rate and fatality rate must be attributed to improved flight safety, i.e., more disciplined flight procedures, the multi-engine aircraft, the advent of the jet engine, etc., and improved survival potential, i.e., use of parachutes and other survival gear. Crashworthy improvements may have had

some impact on this declining fatality rate; however, this is difficult to assess. About the only substantial crashworthiness improvements evident in the 1967 to 1974 cargo/transport accidents are the enforcement of more rigid cargo restraint criteria and the more predominant use of upgraded, aft-facing passenger seats.

CARGO/TRANSPORT ACCIDENT STATISTICS 1967 THROUGH 1974

A review of the accident experience in the eight years, 1967 through 1974 time period, reveals a steady decline in the major accident rate expressed as major cargo/transport accidents per 100,000 flying hours. Table I indicates the overall record of cargo aircraft accidents per year from 1967 through 1974. Also shown in this table are the associated accident rates.

In order to provide more perspective on the crashworthy potential of these aircraft, those accidents in which at least one individual had a remote possibility of survival were selected for detailed analysis. These survivable accidents are listed in Table II. Statistical results derived from these accidents are shown in Table III.

Figure 2 depicts the major accident rate as well as the fatal accident rate. As can be seen, the major accident rate has declined from 1.46 in 1967 to a low of 0.52 in 1973. In 1974 the rate rose to 1.07 to approximate the overall 8-year rate of 1.04. The fatal accident rate

remained rather steady from 1967 through 1973, at about 0.50 fatal accidents per 100,000 flying hours; however, from 1971 through 1974 this rate fluctuated between 0.17 and 0.45. There were fewer than 10 fatal accidents in each of these last four years. A larger number of events would have enabled more confident statistics. Nevertheless, the ratio of major accidents to fatal accidents has lingered between two and three for the 8-year period, which would indicate less than optimum progress in developing and installing crashworthy improvements. This comparison becomes even more revealing when one considers the inflationary trends of current economics. It now takes less damage to generate a major accident as defined by dollar loss. Therefore, more major accidents can be expected, but the major accident/fatal accident ratio should also increase. A steady decrease in this major accident/fatal accident ratio from 1967 to 1970, those years in which more events should reveal more confident statistics, would indicate a possible deterioration of accident survivability.

A precise measurement to indicate the ability to survive an accident is difficult to derive. A crude approximation, however, can be made by applying the survivability ratio. This ratio, which compares the number of individuals surviving an accident with the number that should have survived, should approach unity for a perfectly crashworthy aircraft.

It is depicted in Figure 3 and shows a highly fluctuating curve. For example, the low number of fatalities from 1971 to 1974 does not provide a statistical population large enough to develop a precise statistical analysis. In 1971 there was only one survivor of 13 individuals who should have survived. This significantly decreased the survivability ratio for that particular year. Nevertheless, the ratio for 1973 and 1974 is about the same as that for 1968, which indicates little progress in improving crashworthy characteristics.

The overall fatality rate of the 8-year period is also plotted in Figure 3. This rate drops from 5.06 in 1967 to 2.07 in 1974, with a deviation to 8.25 in 1970. This departure in the generally declining trend was due to two nonsurvivable C-123 accidents which claimed 115 lives.

Accident statistics for specific cargo/transport aircraft over the 8-year period are indicated in Table IV. Salient statistics in Table IV are depicted in Figure 4 for those aircraft involved in at least one survivable accident.

Attempting to equate the survivability ratio to the overall safety potential of the aircraft is discouraged. To do so, one could incorrectly deduce that the C-141 and the T-29 are very unsafe aircraft in which to travel. Although these two aircraft have unusually low survivability ratios, their fatality rates indicate they are very safe forms of

transportation. This low survivability ratio does reflect the need to improve their crashworthy characteristics. This would further enhance the safety of those systems.

PRIMARY CAUSES OF DEATH

An evaluation of the primary causes of death for those individuals who should have survived these accidents is necessary in order to speculate on the most reasonable methods to improve crash survivability. As stated before, these survivable deaths are those caused by post-crash factors (failure to egress death) or poor crashworthy design (crashworthy death). Reasons for death from post-crash factors include burns/asphyxiation, asphyxiation only, and drowning. Many accident reports do not attempt to distinguish between death by burns and those by asphyxiation; therefore, the category burns/asphyxiation may include many deaths from asphyxiation in which the body also burned. The asphyxiation only category includes those deaths positively attributed to asphyxiation. Drowning deaths are those fatalities in which the diagnosis was made from recovered remains. For those fatalities in which injuries resulted from poor crashworthy design or procedures, some judgment was necessary to determine if the death would be attributed to failure to egress or to mortal injuries. This judgment, in most cases, was based on narratives in the accident report.

Table V lists, by aircraft type, the primary causes of death. One very interesting fact that can be developed from this table is the increasing influence of post-crash factors for the C-130, C-135, and C-141 aircraft, the primary cargo/transport aircraft currently in use. For other aircraft types, 65 percent of the deaths were due to post-crash factors; whereas for these three, 97 percent were because the individuals failed to egress. Improvements in seats and restraint systems may have influenced this statistic. For convenience, Figure 5 depicts these primary causes of death for the C-130, C-135, C-141, the remaining aircraft considered in this study, and a combined total.

FACTORS CONTRIBUTING TO NONSURVIVABILITY

In addition to the primary cause of death, there were several contributing factors which may have influenced the individuals' failure to make a timely egress. Because of present reporting methods, exact determination of these factors is difficult. However, after a detailed analysis of survivable accident reports, some trends were identifiable. These influencing factors are tabulated in Table VI and are shown in Figure 6 as a percentage of the total survivable deaths for all accidents for this time frame. Also shown in Figure 6 is the effect of these contributing factors in accidents involving the C-130, C-135, and C-141.

More than one of these contributing factors can be associated with each survivable death. The frequency of occurrence of several of these factors highlights those areas where crashworthy improvements should be concentrated. Noting high occurrence of fire, blocked egress portal, and panic, especially in our current aircraft, it becomes quite obvious that passengers must be provided more escape opportunity. This can be achieved by reducing the intensity or delaying the onset of post-crash fire and providing a more reasonable escape method. Because of the frequency of confusion (panic or inadequate briefing) and restricted visibility (darkness or smoke), these escape portals must be provided automatically and be easily identifiable. They must not rely on robotic discipline from impact survivors for their proper use.

PROPOSED METHODS TO IMPROVE SURVIVABILITY POTENTIAL

Developing and incorporating crash survivability improvement must be pursued within limited constraints. To make an aircraft completely crashworthy for all occupants under any accident situation is just not reasonable. However, there are several areas that can be explored which do not create excessive weight penalty and are also within the framework of present technology. These solutions must be analyzed judiciously, and then prioritized, so that the greatest benefit can be realized for the resources expended.

The Air Force has developed an automatic instant exit for passenger aircraft. This system, designated ELSIE (Emergency Life Saving Instant Exit), provides escape portals by detonating a shaped charge when high deceleration forces, typical of an accident, are experienced. Based on the statistics compiled in this report, it is estimated that this feature alone would have definitely saved over 50 percent of the survivable deaths occurring in the C-130, C-135, and C-141 aircraft. These were the deaths confirmed as asphyxiation. ELSIE has been successfully tested on a static mock-up and has been installed on C-131 aircraft for operational testing. The effectiveness of this system will not be completely understood unless the test aircraft crash; however, one initial apprehension which surrounded its employment, that of inadvertent detonation, has been somewhat relieved.

Numerous studies and reports[1, 2, 3, 7, 8] have stressed the need to retard the occurrence of post-crash fire. This current study indicates that over 80 percent of the survivable deaths were complicated by fire. Although there have been proposals for fire containment, i.e., use of gelled aircraft fuels and installation of self-sealing or honeycomb fuel tanks, these improvements would be costly from an operational or retrofit standpoint. A more economical approach to reduce the hazards of post-crash fire is the

use of lower volatility jet fuel. A comparison of accident experience with low and high volatility[8] fuels currently in use indicates the high volatility fuels "have been responsible for more fire deaths than has low volatility kerosine."

The Air Force is currently evaluating fabrics and materials to determine their fire-resistant characteristics. This evaluation, being accomplished under contract, will identify the most suitable materials, not only from the standpoint of flame-resistant qualities but also of their potential to produce toxic pyrolytic by-products, for use in aircraft interiors.

Another consideration to reduce the impact of post-crash fire is to install fire suppression systems within the aircraft fuselage. The Air Force is now evaluating the potential of such an approach. It is expected that such a system would provide approximately 120 seconds of escape time.[1]

A lethal toxic-thermal environment can occur within minutes following an aircraft accident. This fact was evident during a C-135 crash in 1968 in which all 13 occupants died. Twelve were unable to escape because of this rapid build-up of a toxic environment and died of asphyxiation; one did manage to escape but died later of burns and pulmonary complications. In order to extend the ability of the crash victim to function in a smoke and toxic environment, a lightweight smoke hood has been developed which would

provide three to four minutes of rebreathable air. There have been several hoods developed which fulfill this requirement; however, reviews by the Air Transport Association of America and the National Academy of Sciences-National Research Council have been less than enthusiastic.[9] These reviews elaborate on the dangers of hypoxia and increased carbon dioxide levels. Although these hazards do exist, the immediate hazard of breathing the lethal, post-crash atmosphere in the aircraft cabin certainly outweighs any hazard which may result from failure to remove the hood once outside the aircraft.

The two reasonable objections to a smoke hood are the apprehension which may be created when explaining its use during the preflight briefing and the ability of the passengers to properly don the item during the chaotic events following impact. The former consideration is not believed consequential for individuals traveling on Air Force aircraft. However, very recent experience indicates that such devices would probably not be used even if available. In this incident a C-141 experienced a rapid decompression less than 30 minutes after the passengers were briefed. Only one of the 11 passengers, an Air Force pilot, properly donned the deployed oxygen mask. The remainder had to be assisted; nine of these experienced loss of useful consciousness.

This brings up another point, the value of briefings and alerting systems. Judging from the incident mentioned above, the effectiveness of the preflight briefing, regardless of how detailed, is suspect. Also, in a previous analysis on passenger egress,[1] warning bells/alarms or public address systems prior to the crash were found to be of little value. In this former analysis, only one survivor, in all the accidents reviewed, recalled hearing the bell ring. This fact further substantiates the need to automatically provide a clearly visible escape portal which is usable even when panic and chaos prevail.

There is still room for improvement in passenger seats/ restraints as well as cargo restraining systems. For example, the use of upgraded side-facing seats, developed by the US Army for use in their advanced helicopters, should be included in future aircraft design specifications. However, when considering the number of deaths directly attributed to deficiencies in these items, especially in the cargo aircraft currently on line, additional improvements should be secondary in priority to improving egress methods. This conclusion considers only those circumstances involving survival; there may be sufficient need to improve these systems to prevent nonlethal injury, but this need is beyond the scope of this study.

One final consideration is the need to provide adequate emergency lighting. In the previous analysis on passenger

egress,[1] survivors did not consider the post-crash lighting sufficient in any of the accidents. There is a definite need to position impact-initiated lights, of adequate intensity level, to direct occupants to the nearest usable escape exits. These lights should be located well below the ceiling to avoid being obscured by rising smoke.

CONCLUSION

Safety of flight has improved steadily over the past several decades. The fatal accident rate and fatality rate for cargo/transport aircraft currently being used on the line are substantially lower than for similar mission aircraft used earlier in the 1967 through 1974 study time frame. However, the ability to survive accidents, as reflected in the survivability ratio, has not increased significantly. Definite improvements in crashworthy design are required.

Considering the causes of death in the survivable crashes, the most significant reason in the modern transport fleet is exposure to post-crash factors, i.e., failure to egress after the aircraft has come to rest.

The Air Force is currently reevaluating proposed methods to improve crash survivability. This appraisal will consider all potential approaches and will attempt to develop a program to realize the greatest benefits from the monetary resources expended. Those proposals which appear to warrant

further attention are:

- Automatically initiated instant exits
- Improved emergency lighting
- Use of fire-retardant materials
- Use of improved, self-sealing fuel tanks or fuels with improved flammable characteristics

Additional changes are also being considered in the accident investigating and reporting procedures. Current accident investigations are oriented primarily to the cause of the accident and ways to prevent future similar occurrences. There is nothing wrong with this primary objective; however, little attention is now being directed to passenger survival. In all the accident reports reviewed, only a few indicated the cause of the passenger's death and none identified why these fatal events occurred. Unless we consider the question of why fatal circumstances evolved, as well as what caused the death, improvements must rely on conjecture and calculated judgment rather than precise documented evidence. To this end, the Air Force has proposed methods to improve accident investigator training curricula and accident report formats. As such, long range goals of crash survivability may be more thoroughly understood and corrective measures implemented.

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TABLE I

USAF CARGO/TRANSPORT ACCIDENTS AND RATES

1967 - 1974

Year	Flying Hours $\times 10^{-5}$	Major Accidents No	Major Accidents Rate	Fatal Accidents No	Fatal Accidents Rate	Fatalities No	Fatalities Rate
1967	33.63	49	1.46	16	0.48	170	5.06
1968	37.29	48	1.29	19	0.51	145	3.89
1969	32.90	34	1.03	16	0.49	116	3.53
1970	28.67	28	0.97	14	0.48	239	8.35
1971	24.74	18	0.73	7	0.28	54	2.18
1972	22.15	19	0.86	10	0.45	56	2.53
1973	17.37	9	0.52	3	0.17	34	1.96
1974	15.01	16	1.07	6	0.40	31	2.07
TOTAL	211.76	221	1.04	91	0.43	845	3.98

TABLE II

CAUSE OF DEATH BY INDIVIDUAL ACCIDENT

1967 - 1974

Year	Acft	Survivors	Survivable Deaths	Burns/ Asphyx	Asphyx Only	Drown	Crashworthy Deaths
1968	C-7	2	2				2
1969	C-47	8	1				1
1970	C-47	3	2	2			
1971	C-47		2	2			
1972	C-47	8	2	1			1
1968	C-54	3	1	1			
1969	C-97	7	4	4			
1968	C-119	25	3	1			2
1969	C-119	4	3	2			1
1970	C-119	2	6	3			3
1967	C-121	1	7				7
1969	C-121	12	4	2			2
1970	T-29	1	7	7			
1967	C-123	3	1	1			
1967	C-123	4	1				1
1968	C-123		1	1			
1969	C-123	33	13	13			
1969	C-123	4	1	1			
1970	C-123	1	2				1
1967	C-130	3	3	3			
1967	C-130	21	35		35		
1967	C-130	1	3	3			
1968	C-130	8	6	5			1
1968	C-130	18	1				1
1969	C-130	1	13			13	
1971	C-130	1	10		10		
1972	C-130	7	1				1
1972	C-130	3	5	5			
1967	C-135	4	1				1
1968	C-135		13	1	12		
1968	C-135	45	11		11		
1972	C-135		5	5			
1973	C-135	2	1	1			
1974	C-135	5	2	1	1		
1967	C-141	1	5	5			
1967	C-141	2	7	2		5	
TOTALS		243	185	72	69	19	25

TABLE III

SURVIVABLE CARGO/TRANSPORT AIRCRAFT ACCIDENTS

1967 - 1974

Year	Survivable Accidents	Survivors	Deaths	Impact Fatalities	Survivable Deaths	Survivability Ratio
1967	9	40	74*	3	63	0.39
1968	9	134	60	9	51	0.72
1969	6	36	33	7	26	0.58
1970	4	7	24	7	17	0.29
1971	2	1	15	3	12	0.08
1972	4	18	13	0	13	0.58
1973	1	2	3	2	1	0.67
1974	1	5	2	0	2	0.71
TOTAL	36	243	224	31	185	0.57

*8 missing - cause of death unknown

TABLE IV

ACCIDENT STATISTICS BY AIRCRAFT

1967 - 1974

Acft	Flying Time $x10^{-5}$	ALL ACCIDENTS Fatal Accidents No	ALL ACCIDENTS Fatal Accidents Rate	ALL ACCIDENTS Fatalities No	ALL ACCIDENTS Fatalities Rate	SURVIVABLE ACCIDENTS No	SURVIVABLE ACCIDENTS Survivors	SURVIVABLE ACCIDENTS Survivable Deaths	SURVIVABLE ACCIDENTS Survivability Ratio
C-7	6.43	4	0.62	43	6.68	1	2	2	0.50
C-9	1.40	1	0.71	3	2.14	0			
C-46	0.05	1	20.00	9	180.00	0			
C-47	12.50	11	0.88	60	4.80	4	19	7	0.73
C-54	3.74	2	0.54	5	1.36	1	3	1	0.75
C-97	5.98	1	0.17	4	0.67	1	7	4	0.64
C-119	4.02	5	1.24	31	7.71	3	31	12	0.72
C-121	6.19	3	0.48	37	5.98	2	13	11	0.54
C-123	6.28	13	2.07	193	30.73	6	45	19	0.70
C-124	12.38	3	0.24	28	2.26	0			
C-130	40.21	22	0.55	235	5.84	9	63	77	0.45
C-133	2.73	1	0.37	5	1.83	0			
C-135	31.67	14	0.44	115	3.63	6	56	33	0.63
C-141	39.97	4	0.10	43	1.07	2	3	12	0.20
T-29	18.93	2	0.11	16	0.84	1	1	7	0.125
T-39	10.54	4	0.38	18	1.71	0			
Other	8.74	0		0					
TOTAL	211.76	91	0.43	845	3.99	36	243	185	0.57

TABLE V

CAUSE OF DEATH IN SURVIVABLE ACCIDENTS BY AIRCRAFT

1967 - 1974

Aircraft	Survivors	Survivable Deaths	Failure to Egress Deaths: Burns/ Asphyx	Failure to Egress Deaths: Asphyx Only	Failure to Egress Deaths: Drown	Crashworthy Deaths
C-7	2	2				2
C-47	19	7	5			2
C-54	3	1	1			
C-97	7	4	4			
C-119	31	12	6			6
C-121	13	11	2			9
C-123	45	19	16		1	2
C-130	63	77	16	45	13	3
C-135	56	33	8	24		1
C-141	3	12	7		5	
T-29	1	7	7			
TOTALS	243	185	72	69	19	25
C-130) C-135) C-141)	122	122	31	69	18	4
All Other Aircraft	121	63	41	0	1	21

TABLE VI

FACTORS CONTRIBUTING TO DEATH

1967 - 1974

Aircraft	Survivable Deaths	Egress Blocked	Impaired by Injury	Confusion	Fire	Lack of Visibility	No Restraint	Restraint/ Seat Failed	Cargo	Trapped
C-7	2						2			
C-47	7	1	1		5		1	2		
C-54	1		1		1					
C-97	4	1	2	4	4	4				
C-119	12		1	4	6	3	3	6		6
C-121	11		2	7	2				2	
C-123	19		9	15	15	1	3	8		
C-130	77	49	6	48	60	10	3	1	7	3
C-135	33	14	3	24	32	26	1	4		
C-141	12		2					2		
T-29	7				7					
<u>TOTALS</u>										
C-130) C-135) C-141)	122	63	11	72	92	36	4	7	7	3
All Acft	185	65	27	102	125	44	13	23	9	9
All Other Aircraft	63	2	16	30	33	8	9	16	2	6

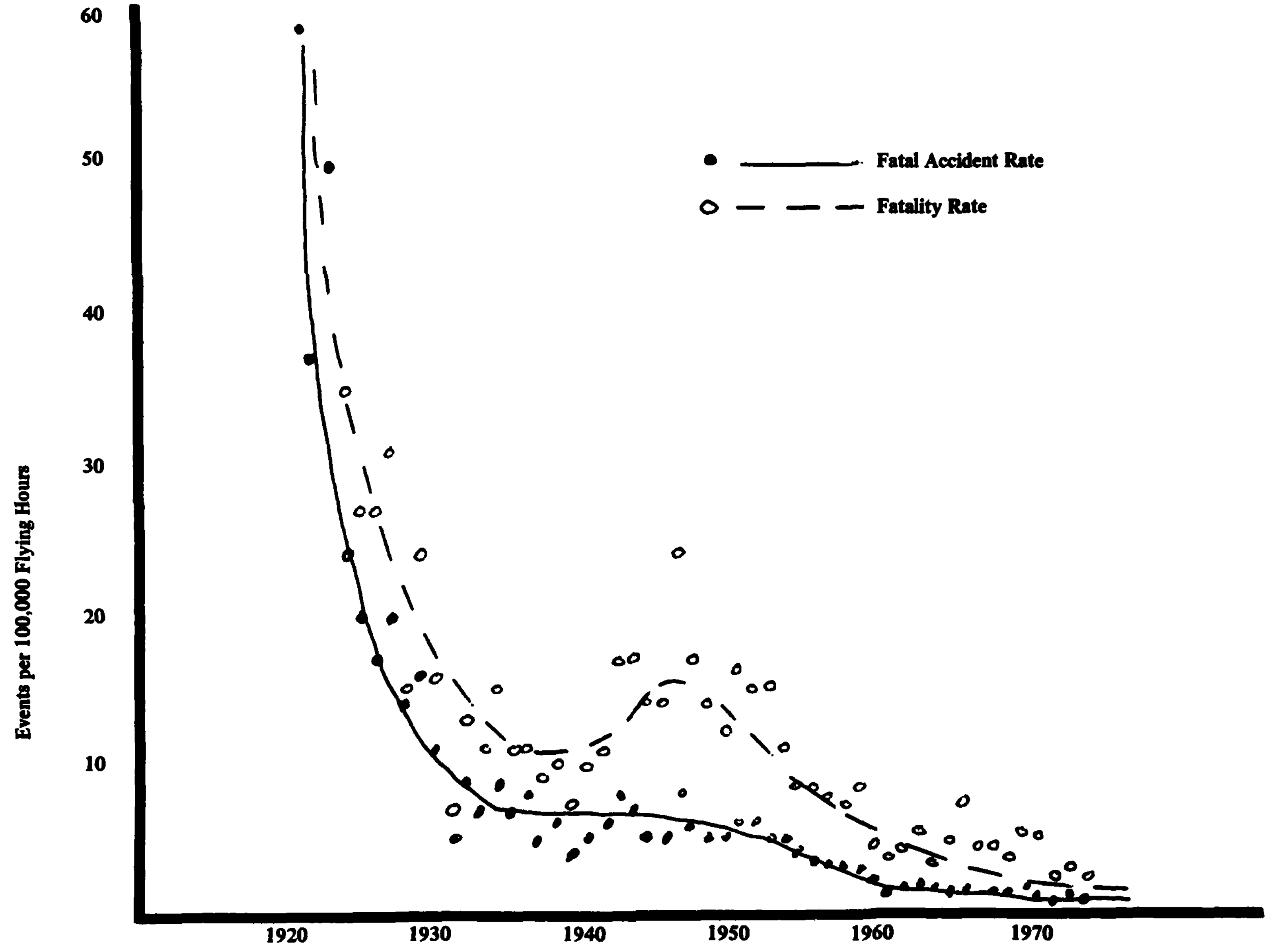

Figure 1 - U A Air Force Fatal Accident and Fatality Rate 1921 to 1973

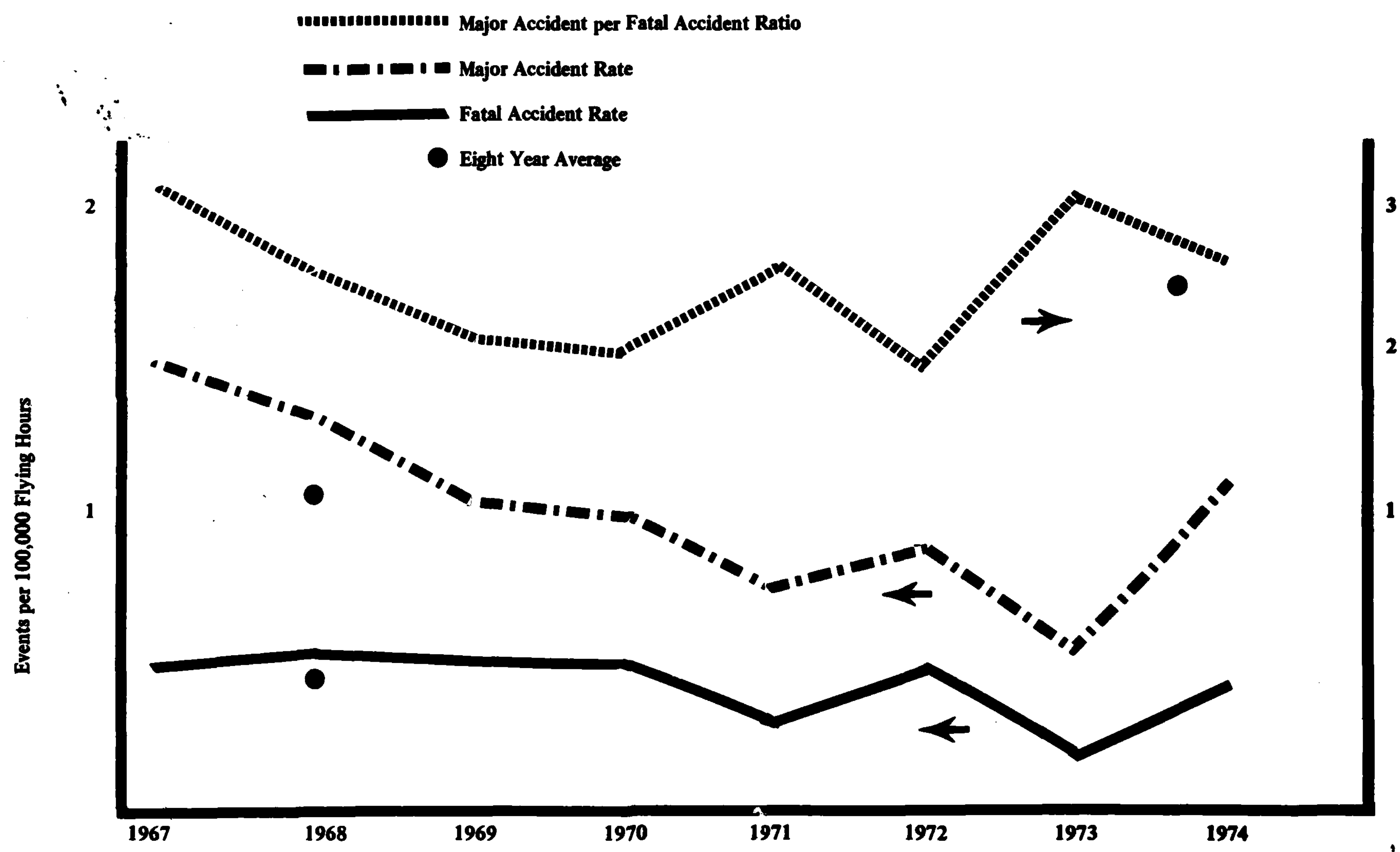

Figure 2 - U S Air Force Accident Statistics 1967 Through 1974

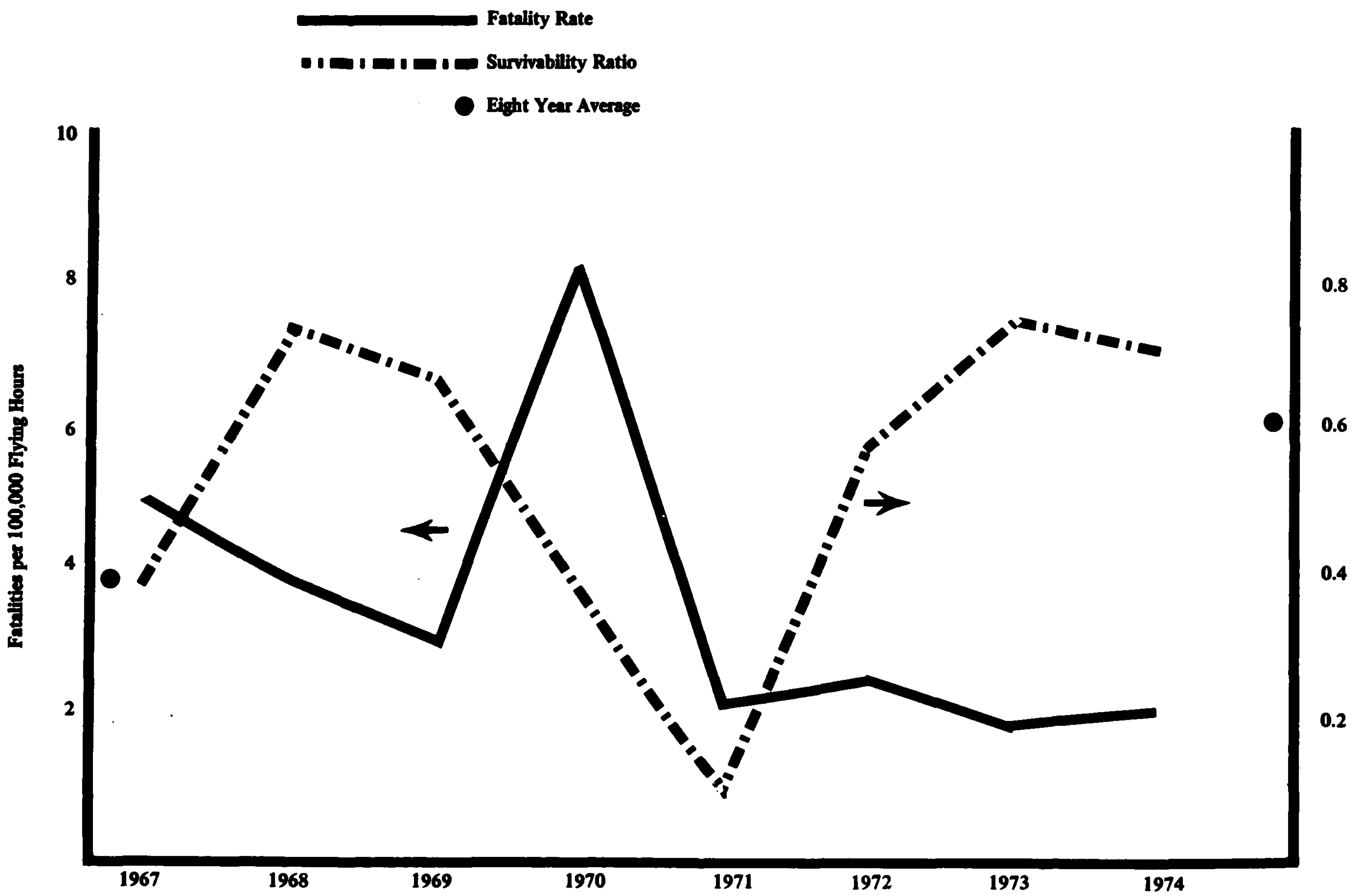

Figure 3 - U S Air Force Aircraft Fatality Rate and Survivability Ratio - 1967 through 1974

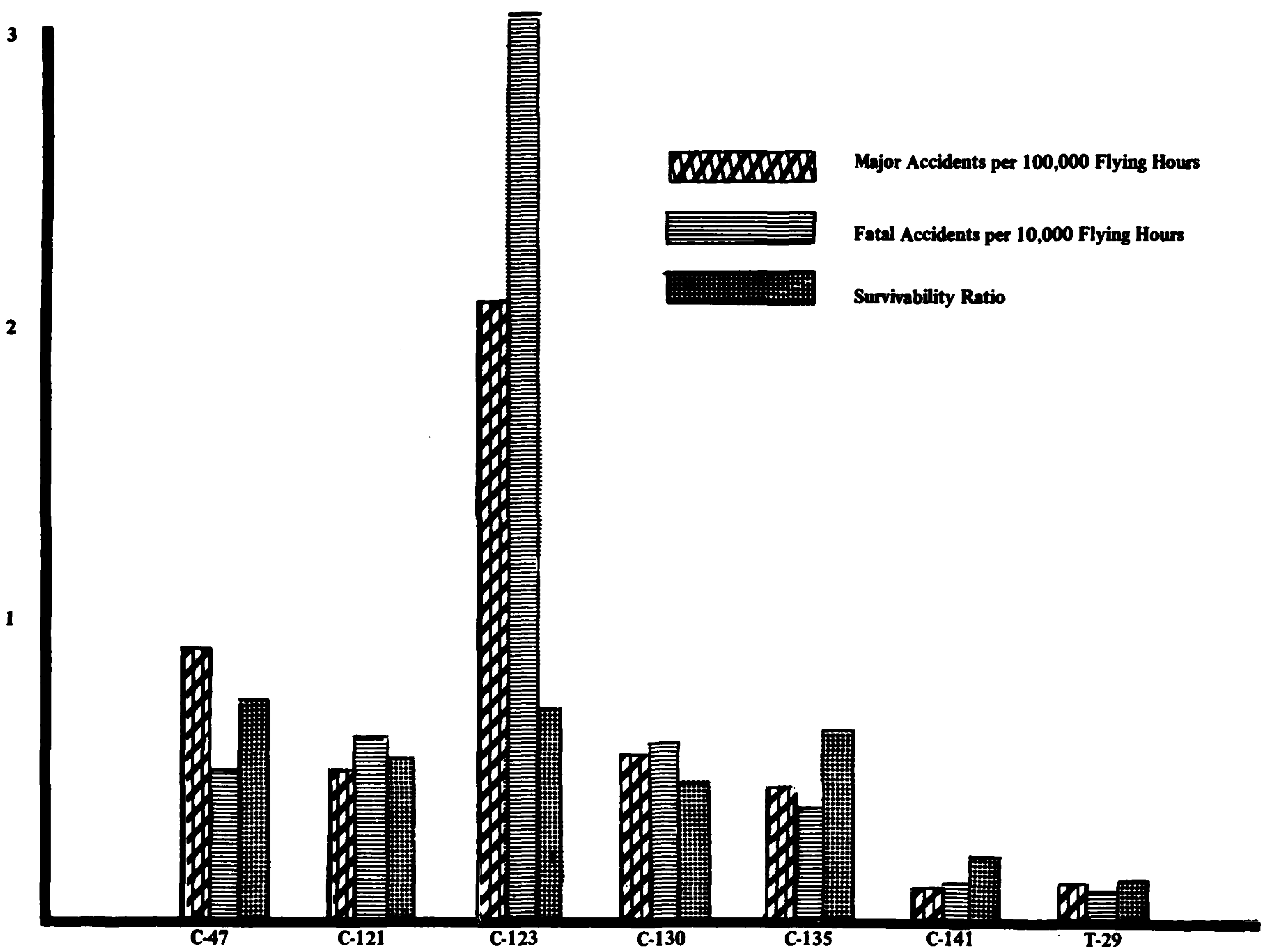

Figure 4 - Accident Statistics for Selected U S Air Force Aircraft 1967 - 1974

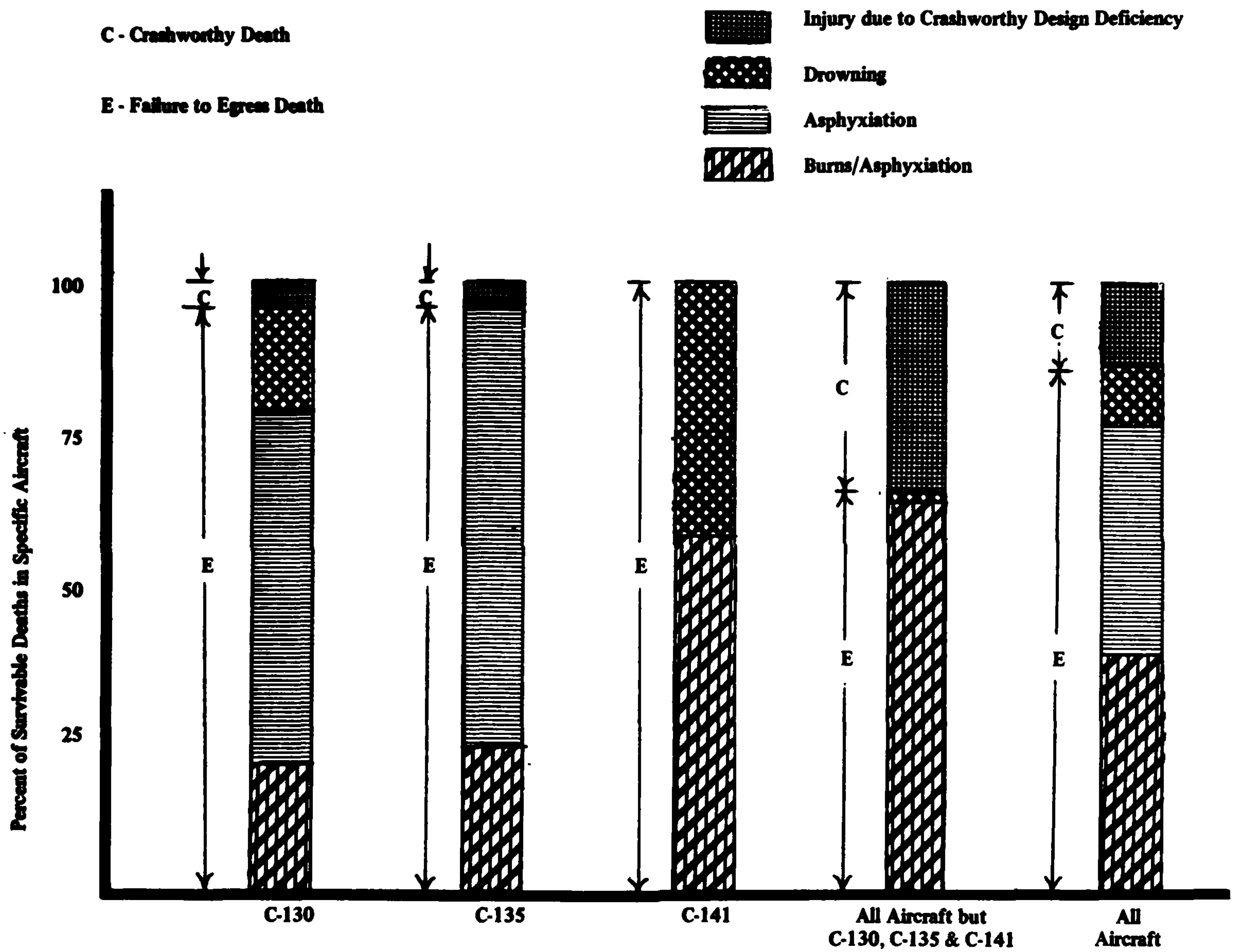

Figure 5 - Cause of Death in Survivable Accidents of Selected U S Air Force Aircraft 1967 through 1974

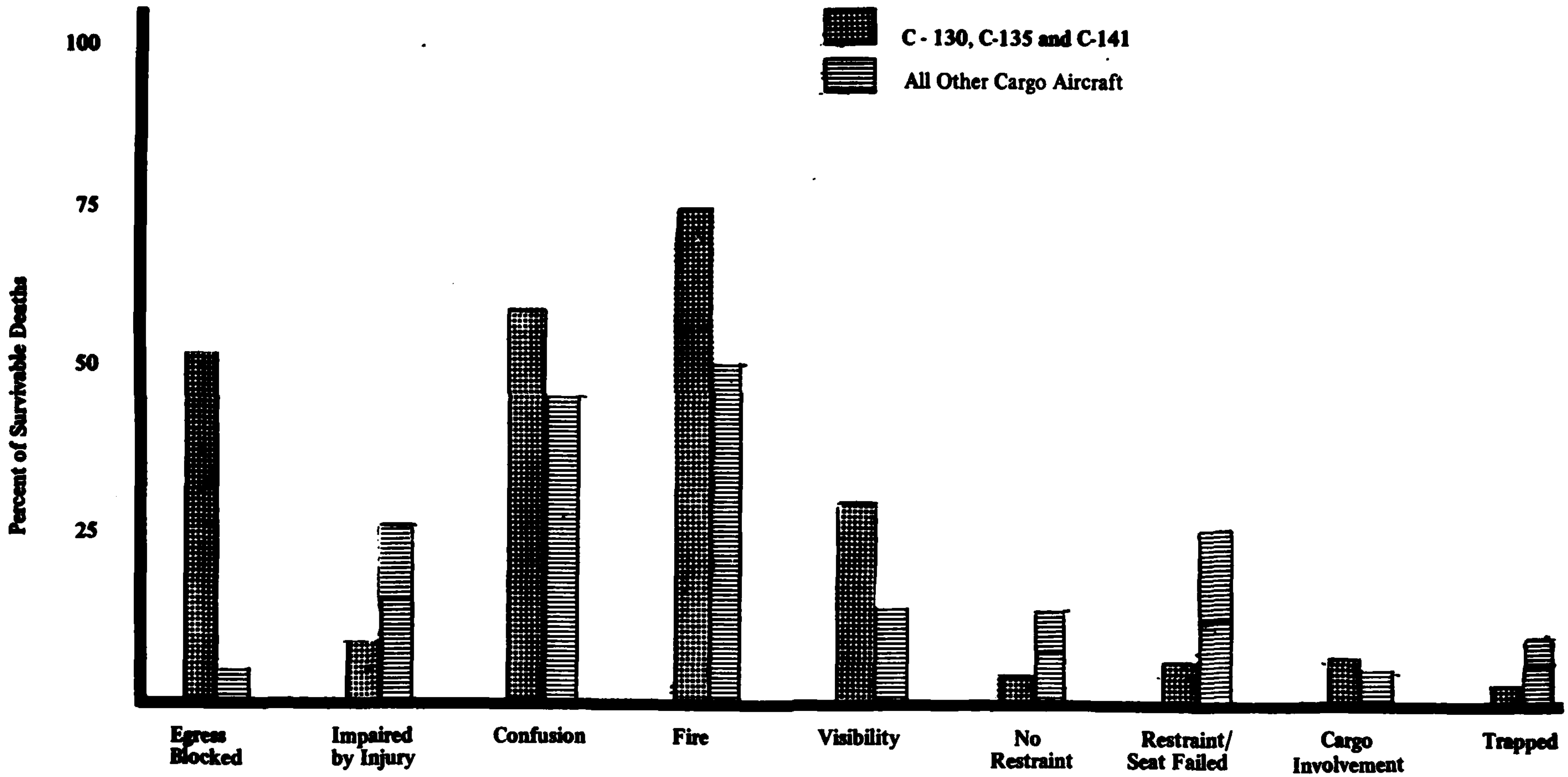

Figure 6 - Factors Contributing to Death in Survivable U S Air Force Accidents - 1967 through 1974

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